Trend Study 21-6-03

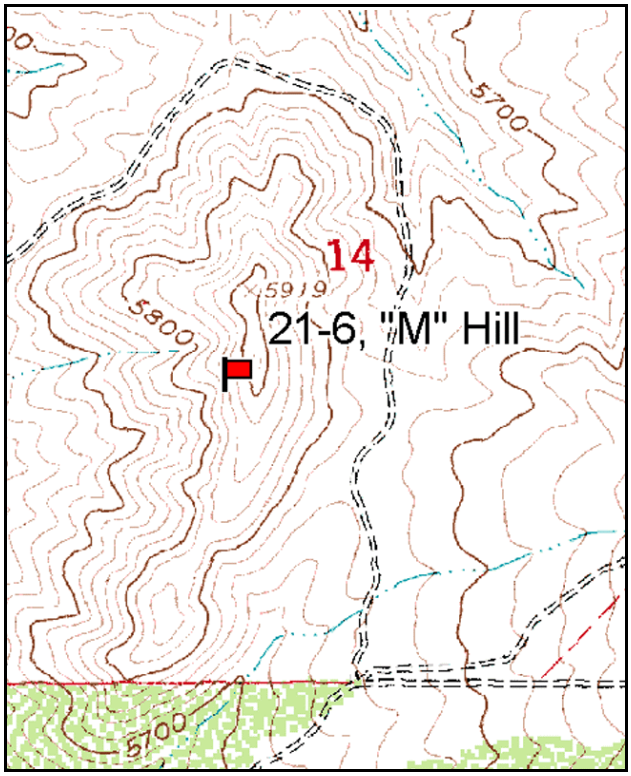
Study site name: 'M' Hill . Vegetation type: Mtn. Brush Chaining .

Compass bearing: frequency baseline 180 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft). No rebar.

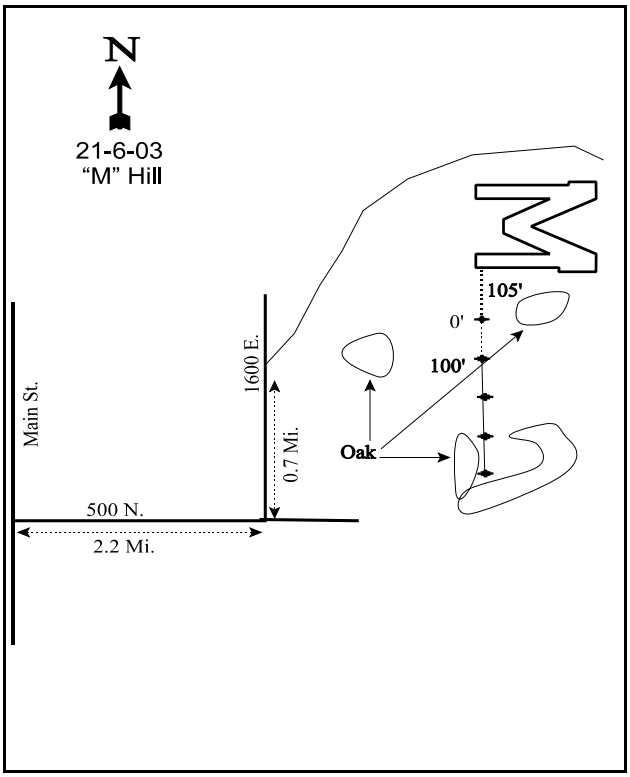
LOCATION DESCRIPTION

This transect is located near the 'M' on the hill northeast of Fillmore. Starting at the junction of 500 North and Main Street in Fillmore, go east 2.2 miles to the base of 'M' Hill. The road that goes to the top of 'M' Hill has been closed. Turn left (north) at the gun range and drive 0.7 miles to the closed road. Hike to the 'M'. The frequency baseline starts 105 feet true south of the bottom of the south leg of the concrete 'M'. The baseline is marked by 2 ½ foot tall steel rebar. The 0-foot baseline stake is tagged #7112.



Map Name: Fillmore

Township 21S , Range 4W , Section 14



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4315603 N, 389878 E

DISCUSSION

'M' Hill - Trend Study No. 21-6

This trend study is located on DWR land on the first large hill east of Fillmore. Further east, there is about 2 miles of rolling juniper-covered foothills below the 7,000 foot winter range limit. There is some development of homes on private land in the foothills above the transect. Elevation of the study site is 5,800 feet on a moderately steep (30-35%) west facing slope. The site was chained more than 30 years ago and is now dominated by a mixture of shrubs. Cattle grazing was heavy in the past, but is only light at the present time. Deer use appeared to be moderate to heavy when the site was established, but has lessened since. Pellet group data from 1998 estimated 23 deer, 6 elk, and 6 cow use days/acre (57 ddu/ha, 15 edu/ha, and 15 cdu/ha). Use was estimated at 50 deer (122 ddu/ha) and 7 elk days use/acre (17 edu/ha) in 2003. There is ample thermal cover available in the area from juniper.

Soil on the site has moderate depth estimated at almost 14 inches. Texture is a loam with a neutral pH (6.9). Phosphorus is 8.4 ppm, which is slightly below the 10 ppm thought necessary for normal plant development. Rock and pavement are abundant on the surface with cover values ranging from 29% in 1985 to 22% in 2003. Rock and gravel are also common throughout the profile. There is some soil movement down slope as evidenced by pedestalling around the base of shrubs and bunchgrasses, but erosion is not severe. An erosion condition class assessment rated soils as stable in 2003. The ratio of protective cover to bare soil declined by nearly half between 1998 and 2003 due to the increase in bare ground and resultant decreases in vegetation and litter.

The browse community at "M" Hill is diverse. Gambel oak and Utah juniper are the dominant types with lower amounts of preferred species including true mountain mahogany, Stansbury cliffrose, serviceberry, and mountain big sagebrush also being present. Gambel oak occurs in dense, scattered patches and had an estimated density of about 3,000 stems/acre in both 1998 and 2003. The young age class has been abundant in all years with decadence being low. Mature oak stems have averaged between 3 and 5 feet in height, and use on oak is mostly light. A portion of the oak population was noted as being severely defoliated by grasshoppers in 1985. Herbaceous understory species and mountain mahogany were also heavily impacted by grasshoppers that year. Point quarter data from 2003 estimated an average juniper density of 132 trees/acre. Canopy cover of oak and juniper averaged 12% and 8% in 2003 respectively.

Preferred browse species all occur in low densities. True mountain mahogany is the most abundant of the preferred types with an estimated density of about 300 plants/acre in all years. Use on mahogany was light to moderate from 1985 to 1998, and moderate to heavy in 2003. Mature mahogany plants averaged over 6 feet in height in 2003, and are becoming more unavailable to browsing deer. The mahogany population has displayed normal vigor since 1991 and percent decadence has always been low in all readings. The young age class has been moderate in most years with 20% of the population being classified as such in 2003. Mahogany leaders had an average annual growth of 2.6 inches in June 2003. Cliffrose had an estimated density of 160 plants/acre in 1998, decreasing to 120 plants/acre in 2003. The cliffrose population has become increasingly decadent in 1998 and 2003 at 38% and 83% respectively. With no young plants sampled in any reading, this population looks to be slowly dying off. Serviceberry was not sampled in the density strips but was measured for average height and crown in 2003. Two less preferred species, prickly phlox and broom snakeweed, both showed large decreases in density between 1998 and 2003.

The herbaceous understory is diverse and moderately abundant. Bluebunch wheatgrass dominates the grass component providing 72% and 88% of the grass cover in 1998 and 2003 respectively. Sandberg bluegrass was the second most abundant grass in 2003. Cheatgrass, which was moderately abundant in 1998, significantly decreased in frequency in 2003. Cheatgrass occurs mostly on the south aspects. Forbs were very

abundant in 1998 with 20 species being sampled. However, composition was dominated by poor forage species including pale alyssum, rock goldenrod, and desert phlox. In 2003, 15 forb species were sampled although most showed a decline in frequency and cover values compared to 1998. There are few desirable forbs present, although penstemon, lobeleaf groundsel, and heartleaf twistflower receive some use from wildlife.

1985 APPARENT TREND ASSESSMENT

Soil erosion is ongoing and there appears to be heavy losses from some open spots in the past. Presently, there is a variety of desirable browse species, but the spreading oak brush, lack of young plants, and increasing unavailability due to height of the key species indicates a downward trend in terms of deer winter range.

1991 TREND ASSESSMENT

None of the basic cover measurements have changed significantly since 1985. Vegetative basal cover has decreased slightly, down to 6%. Rock/pavement cover has decreased from 30% to 27%. Litter cover has increased to 47%, while percent bare ground has increased slightly from 20% to 21%. Soil trend for the site is considered stable, but percent bare ground should be monitored closely. Key browse for the area is Gambel oak and true mountain mahogany. Because of it's high density (7,932 plants/acre), oak is the most important browse. Oak has decreased by 5% since 1985, while percent decadency has increased to 17%. The more highly preferred browse, mahogany, is in such low numbers (266 plants/acre) that it would be utilized well before winter has set in. Trend for browse is stable. There are not many grass species on the site. The most abundant species is bluebunch wheatgrass with a quadrat frequency of 75%. Of the 13 species of forbs, only five have quadrat frequencies that exceed 10%. Surprisingly, the forbs demonstrated an increase in sum of nested frequency values. Trend for herbaceous understory is slightly improving.

TREND ASSESSMENT
soil - stable (3)
browse - stable (3)
herbaceous understory - slightly improving (4)

1998 TREND ASSESSMENT

Trend for soil is up with a major decline in cover of bare ground from 21% to 9%. Rock and pavement cover also increased as did litter cover. Erosion does not appear to be a serious problem on this site at this time. Trend for browse is stable. The preferred species, true mountain mahogany and cliffrose have small but stable populations. Mahogany displays light use and low decadence while cliffrose is moderately utilized. Gambel oak is the dominant browse on the site. Density has declined since 1991, but most of the change is due to the much larger sample size used in 1998. Density of mature plants has remained similar (1,866 vs 1,600) but the number of young has declined by fourfold (5,600 in 1991 to 1,400 in 1998). Utilization is light to moderate, vigor good, and percent decadence low at only 1%. Trend for the herbaceous understory is stable with similar sum of nested frequency values for perennial grasses and forbs compared to 1991. However, forb cover is dominated by poor value species including rock goldenrod, desert phlox, and pale alyssum.

TREND ASSESSMENT
soil - up (5)
browse - stable (3)
herbaceous understory - stable (3)

2003 TREND ASSESSMENT

Trend for soil is slightly down. Decreasing vegetation and litter cover values and the resultant increase in bare ground has resulted in less protective cover on the soil surface. The ratio of protective cover to bare soil is only one-half of what it was in 1998. Erosion remains within acceptable levels. Trend for browse is stable. Although less preferred, Gambel oak is the most abundant browse on the site remaining at a stable density in 2003. The Gambel oak population has good reproduction, low decadence, and shows light use. The more preferred species remain in limited densities. True mountain mahogany remains the most abundant of the preferred species with a density of 300 plants/acre. Use on mahogany was moderate to heavy in 2003, although mature individuals are beginning to grow out of the reach of browsing deer with an average height of over 6 feet. In 2003, mahogany vigor was normal and decadence low. Cliffrose density slightly declined in 2003 to 120 plants/acre. Due to low density, cliffrose showed heavy use in 2003 as browsing animals key on this species. Decadence increased to 83% in 2003 which is a definite negative sign. This population will likely decline in the future as no young plants have been sampled in any reading. Trend for the herbaceous understory is stable. Sum of nested frequency for perennial grasses and forbs decreased as group, but the most abundant perennial species, bluebunch wheatgrass, remained stable. Other positive signs were the increases in Sandberg bluegrass frequency and the significant decrease in cheatgrass. Forb abundance was much lower than in 1998. However, this is expected with drier conditions compared to 1998 and should improve with better precipitation. The decrease in forbs was not large enough to warrant a downward trend.

TREND ASSESSMENT
soil - slightly down (2)
browse - stable (3)
herbaceous understory - stable (3)

HERBACEOUS TRENDS --
Management unit 21 , Study no: 6

Type	Species	Nested Frequency				Average Cover %	
		'85	'91	'98	'03	'98	'03
G	Agropyron spicatum	169	207	198	180	8.30	10.81
G	Bromus japonicus (a)	-	-	14	-	.19	-
G	Bromus tectorum (a)	-	-	$_{b}$175	$_{a}$28	1.99	.13
G	Oryzopsis hymenoides	-	1	2	2	.38	.18
G	Poa bulbosa	-	-	-	7	-	.04
G	Poa fendleriana	-	-	-	-	.00	-
G	Poa secunda	$_{ab}$33	$_{a}$17	$_{ab}$37	$_{b}$67	.52	1.03
G	Sitanion hystrix	-	5	7	1	.06	.01
Total for Annual Grasses		0	0	189	28	2.18	0.12
Total for Perennial Grasses		202	230	244	257	9.28	12.09
Total for Grasses		202	230	433	285	11.47	12.22
F	Agoseris glauca	-	-	7	-	.01	-
F	Alyssum alyssoides (a)	-	-	$_{b}$234	$_{a}$3	1.81	.03
F	Arabis spp.	-	3	1	-	.01	-

Type	Species	Nested Frequency				Average Cover %	
		'85	'91	'98	'03	'98	'03
F	Astragalus spp.	$_{a}$-	$_{b}$22	$_{b}$19	$_{a}$2	.16	.00
F	Cirsium spp.	-	-	3	1	.06	.00
F	Collinsia parviflora (a)	-	-	-	3	-	.00
F	Cryptantha spp.	$_{ab}$12	$_{b}$14	$_{ab}$6	$_{a}$3	.08	.03
F	Descurainia pinnata (a)	-	-	24	11	.07	.08
F	Draba spp. (a)	-	-	3	-	.00	-
F	Erodium cicutarium (a)	-	-	1	-	.01	-
F	Galium multiflorum	$_{a}$-	$_{a}$-	$_{b}$44	$_{a}$10	.50	.18
F	Gilia spp. (a)	-	-	-	3	-	.00
F	Lactuca serriola	$_{a}$-	$_{ab}$1	$_{b}$11	$_{a}$-	.05	-
F	Linum lewisii	-	5	4	-	.06	-
F	Machaeranthera canescens	$_{a}$3	$_{b}$24	$_{a}$-	$_{a}$-	.00	-
F	Microsteris gracilis (a)	-	-	26	-	.12	-
F	Penstemon spp.	9	5	9	4	.05	.01
F	Petradoria pumila	$_{bc}$110	$_{c}$119	$_{b}$70	$_{a}$39	2.92	1.22
F	Phlox austromontana	$_{a}$13	$_{b}$53	$_{ab}$40	$_{a}$28	1.94	.64
F	Physaria chambersii	-	-	4	-	.03	-
F	Phlox longifolia	$_{a}$-	$_{a}$-	$_{b}$22	$_{b}$15	.14	.17
F	Ranunculus testiculatus (a)	-	-	8	-	.01	-
F	Senecio multilobatus	$_{b}$10	$_{a}$-	$_{a}$-	$_{a}$5	-	.01
F	Streptanthus cordatus	6	9	14	3	.21	.01
F	Tragopogon dubius	-	2	-	3	.00	.03
F	Unknown forb-perennial	-	2	-	-	-	-
Total for Annual Forbs		0	0	296	20	2.03	0.11
Total for Perennial Forbs		163	259	254	113	6.26	2.32
Total for Forbs		163	259	550	133	8.29	2.44

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --
Management unit 21 , Study no: 6

Type	Species	Strip Frequency '98	Strip Frequency '03	Average Cover % '98	Average Cover % '03
B	Amelanchier utahensis	0	0	-	.38
B	Artemisia tridentata vaseyana	8	3	1.05	.03
B	Cercocarpus montanus	11	9	3.50	3.92
B	Cowania mexicana stansburiana	8	6	1.56	1.09
B	Gutierrezia sarothrae	23	11	1.33	.10
B	Juniperus osteosperma	8	12	6.07	3.24
B	Leptodactylon pungens	19	7	1.27	.21
B	Quercus gambelii	24	25	8.83	6.56
Total for Browse		101	73	23.63	15.53

CANOPY COVER, LINE INTERCEPT --
Management unit 21 , Study no: 6

Species	Percent Cover '98	Percent Cover '03
Artemisia tridentata vaseyana	-	.21
Cercocarpus montanus	.40	6.06
Cowania mexicana stansburiana	-	1.64
Gutierrezia sarothrae	-	.51
Juniperus osteosperma	10.60	8.33
Leptodactylon pungens	-	.01
Quercus gambelii	6.00	11.98

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 21 , Study no: 6

Species	Average leader growth (in) '03
Cercocarpus montanus	2.6
Cowania mexicana stansburiana	2.0

POINT-QUARTER TREE DATA --
Management unit 21 , Study no: 6

Species	Trees per Acre	
	'98	'03
Juniperus osteosperma	121	132

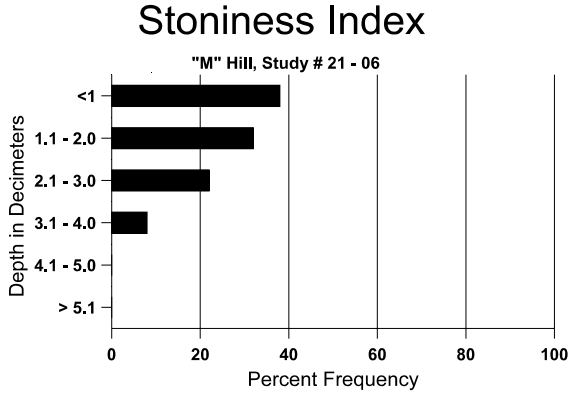
Average diameter (in)	
'98	'03
6.9	5.8

BASIC COVER --
Management unit 21 , Study no: 6

Cover Type	Average Cover %			
	'85	'91	'98	'03
Vegetation	7.75	6.00	41.14	27.70
Rock	13.50	14.00	11.11	12.27
Pavement	15.75	12.75	22.61	9.53
Litter	43.50	46.75	53.05	46.26
Cryptogams	0	0	.10	.27
Bare Ground	19.50	20.50	9.09	18.38

SOIL ANALYSIS DATA --
Management unit 21, Study no: 6, Study Name: “M” Hill

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
13.9	65.2 (15.4)	6.9	51.2	27.4	21.3	4.0	8.4	89.6	0.7



PELLET GROUP DATA --
Management unit 21 , Study no: 6

Type	Quadrat Frequency	
	'98	'03
Rabbit	16	15
Elk	3	1
Deer	16	24
Cattle	-	-

Days use per acre (ha)	
'98	'03
-	-
4 (10)	7 (17)
23 (57)	50 (122)
6 (15)	-

BROWSE CHARACTERISTICS --
Management unit 21 , Study no: 6

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Amelanchier utahensis											
85	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	0	-/-
03	**0**	-	-	-	-	-	0	0	-	0	96/104
Artemisia tridentata vaseyana											
85	**0**	-	-	-	-	-	0	0	0	0	-/-
91	**0**	-	-	-	-	-	0	0	0	0	-/-
98	**220**	-	-	180	40	60	9	0	18	0	31/38
03	**80**	-	-	60	20	-	0	0	25	0	25/39
Cercocarpus montanus											
85	**266**	66	66	200	-	-	25	0	0	25	69/35
91	**266**	-	66	200	-	-	75	0	0	0	87/70
98	**260**	80	140	100	20	-	0	0	8	0	56/55
03	**300**	-	60	220	20	20	27	27	7	0	77/89
Chrysothamnus nauseosus hololeucus											
85	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	0	12/15
03	**0**	-	-	-	-	-	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization				
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Cowania mexicana stansburiana											
85	**0**	-	-	-	-	-	0	0	0	0	-/-
91	**0**	-	-	-	-	-	0	0	0	0	-/-
98	**160**	20	-	100	60	40	75	0	38	0	53/48
03	**120**	-	-	20	100	20	17	83	83	17	66/71
Gutierrezia sarothrae											
85	**66**	-	-	-	66	-	0	0	100	0	-/-
91	**266**	-	66	200	-	-	0	0	0	0	12/10
98	**1740**	80	220	1520	-	-	0	0	0	0	11/11
03	**400**	-	-	380	20	420	0	0	5	5	9/12
Juniperus osteosperma											
85	**133**	66	-	133	-	-	0	0	0	0	69/71
91	**133**	66	-	133	-	-	0	0	0	0	157/197
98	**160**	-	40	100	20	80	0	0	13	0	-/-
03	**260**	20	100	160	-	-	0	0	0	0	-/-
Leptodactylon pungens											
85	**0**	-	-	-	-	-	0	0	0	0	-/-
91	**466**	-	-	466	-	-	0	0	0	0	8/10
98	**3400**	20	280	2700	420	20	0	0	12	0	2/6
03	**380**	-	20	320	40	120	0	0	11	11	2/6
Opuntia spp.											
85	**0**	-	-	-	-	-	0	0	-	0	-/-
91	**0**	-	-	-	-	-	0	0	-	0	-/-
98	**0**	-	-	-	-	-	0	0	-	0	7/15
03	**0**	-	-	-	-	-	0	0	-	0	6/20
Quercus gambelii											
85	**8332**	3800	5266	3066	-	-	0	0	0	0	35/17
91	**7932**	400	5600	1866	466	-	13	0	6	4	60/33
98	**3020**	60	1400	1600	20	660	19	0	1	0	51/41
03	**3080**	100	1160	1600	320	320	0	0	10	6	39/30